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Examination session (May or November)

May

Year

2012

Diploma Programme subject in which this extended essay is registered: Economics

(For an extended essay in the area of languages, state the language and whether it is group 1 or group 2.)

Title of the extended essay: Behavioural economics in poker

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The extended essay I am submitting is my own work (apart from guidance allowed by the International Baccalaureate).

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I enjoyed working with \_\_\_\_\_ on his essay because I learned more from him than he did from me. I think \_\_\_\_\_ has done some innovative thinking about behavioural economics, but I am not sure his research is extensive enough. ?

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Candidate session number

## Achievement level

Criteria	Examiner 1	maximum	Examiner 2	maximum	Examiner 3
A research question	2	2		2	
B introduction	2	2		2	
C investigation	3	4		4	
D knowledge and understanding	3	4		4	
E reasoned argument	3	4		4	
F analysis and evaluation	3	4		4	
G use of subject language	3	4		4	
H conclusion	2	2		2	
I formal presentation	2	4		4	
J abstract	2	2		2	
K holistic judgment	2	4		4	

Total out of 36

27

Q is OK, ABSTRACT IS COMPLETE. INTRODUCTION HAS CONCEPTS AND  
 MISPLACED. WITH THE EXCEPTION OF THE PRESENTATION, THIS IS  
 A VERY HIGH LEVEL OF WRITING. MUCH OF THE APPLICATION TO  
 POWER MUST BE RE-WORKED, I FEEL, BUT I HAVE FOUND NO EVIDENCE

Name of examiner 1: \_\_\_\_\_  
 (CAPITAL letters)

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Examiner number: \_\_\_\_\_

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Date: 28/05

Behavioural economics in poker:

How can a poker player apply behavioural economics to a game of Texas Hold 'Em in order to gain an advantage over the other game participants?

1 RQ.

May, 2012

3988 words

## Abstract

The investigation of my essay was centred on the following research question: how can a poker player apply behavioural economics to a game of Texas Hold 'Em in order to gain an advantage over the other game participants? To investigate this claim, I researched the fundamental theories and objectives of behavioural economics and applied these concepts to a poker game. The major concepts I used were bounded rationality, bounded willpower, and behavioural game theory. After showing the relationship between behavioural economics and poker, I proposed ways in which a poker player could benefit from using behavioural economic theory as a tool for understanding their opponents.

The essay was conclusive in finding appropriate ways of one player obtaining an advantage over another through behavioural economics. Such examples were inducing players into making irrational plays such as calling a bet when they should be folding, forcing a player to go on tilt in order to profit even more, and using behavioural game theory to optimize bluffing strategy against stronger opponents. In the end, it was determined behavioural economics was a complementary to classical economics, and that, as proven by its real application to a poker game, it would be necessary to implement behavioural economics when designing economic models and stimulating economic thought.

RQ

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## Introduction

Behavioural economics is a growing field in economics that studies the variable tendencies of consumers, such as emotions and rationality, and how they affect a market. We can extend the idea of a market to a game of poker, where each poker player in the game is a consumer, and formulate an investigation of the variable tendencies of the poker players based on the parameters of behavioural economics. The worth of such an investigation would be provided by its insight into the rational and irrational behaviours of a consumer, and how this affects strategic decision-making. Poker is a prime environment for studying this behavioural strategic decision-making because it is a game of both imperfect information – cards are hidden from each player, creating a lack of knowledge of future moves – and emotionally-influenced behaviour.

To begin my investigation, I must first define a research question that is clear in focus and narrow in scope. Thus, the question I wish to research is as follows: how can a poker player apply behavioural economics to a game of Texas Hold 'Em in order to gain an advantage over the other game participants? The results of this question will prove, in practical terms, the feasibility of behavioural economic theory in economic thought because it will show how an economic agent is constrained by bound rationality and strategy against other players in the market. It will therefore also indicate a base understanding of how economic systems work, wherein the poker table is an extension of this idea.

The thesis of my paper is that behavioural economic theory can be applied, with game theory, to understand the rationale of a poker player and how their rationale can influence future moves. Thus, an advantage can be made by predicting and preventing the possible choices the poker player will undertake.

## What is behavioural economics?

In order to explore my research question, we must first put into perspective the concerns of behavioural economics. According to behavioural economist Dan Ariely (2009, 0:38), the difference between economics and behavioural economics is that the latter does not assume economic agents are rational. Classical economics would defend the assumption of rationality because when a large sample of people are taken into account, the choices made by the

population on the whole would not deviate from what the theories would suggest, and also that agents would act as if making rational decisions (Friedman, 1953). However, behavioural economics makes the counterclaim that rationality is bounded (Jolls, Sunstein, and Thaler, 1998), which means humans are limited by their cognitive abilities. This limitation does create a deviation from a theory's prediction, which behavioural economics attempts to address. The other two limitations of behavioural economics on economic agents are bounded willpower and bounded self-interest. Jolls et al. explain that bounded willpower is the limit on a person's ability to make the best decision even when they have the knowledge on which decision provides maximum utility, while bounded self-interest is the act of caring for others, whether they are strangers or friends, in certain situations. Note that I will not be examining bounded self-interest in my investigation because it will lead to ethical implications of fairness and compassion, which is outside the scope of my research question. ✓

### **Behavioural economics and poker**

The relationship between behavioural economics and poker derives from choice. A market is the influence of consumer choices; poker is the influence of poker player choices. Behavioural economics is limited by scarcity, which is also valid for poker because of forced action such as blinds and antes. The scarcity of chips forces players to make decisions, which can be influenced by reason and emotion. Since poker is logistically a game of mathematics and logic, reasoned decision-making can be considered rational behaviour while emotional decision-making can be considered irrational behaviour. The emotional decision-making process is subject to the behaviours of the individual. Thus, aspects of behavioural economics, including limitations and behavioural game theory, can be applied to formulate an understanding of how a poker player makes his decisions. ✓

### **Irrationality in poker**

Irrational decision-making is a common and exploitable aspect of poker. As prospect theory states (Kahneman & Tversky, 1979), humans make decisions based on perceived gains and not perceived losses. The problem that arises in poker is an over-value of short-run benefits and an under-value of long-run costs.



For example, in figure 1.1 Doyle and Phil are playing a pot of \$500. Doyle can only win if a diamond comes on the river, excluding the Jack (as it would give Phil a full house). Assuming Doyle believes Phil has two-pair, Doyle would have 8 outs which can win him the hand, and he would therefore have odds to hit 8 out of 44 possible cards, or 5.5:1. With this in mind, Phil bets \$200, giving Doyle pot odds of \$700:\$200 or 3.5:1. Doyle's chance to hit is worse than his pot odds, and he would therefore lose money in the long-run if he made the call. Yet, Doyle might still make the call because he feels like a pot of \$700 is too much to give up, or that in the short-run his benefit could be winning a pot of \$700. This is a miscalculation in his risk, as Doyle has over-valued his short-run benefit. In the long-run he would lose more money than he would gain.

When Doyle makes an under-value of his long-run costs, he is committing irrational behaviour as explained by prospect theory. He is looking at his perceived short-run gains while ignoring his perceived long-run losses, and has come to the false conclusion that it is correct to make the call. In effort, he has tried to serve his best interests while at the same time made a non-profit-maximizing decision.

Shown in figure 1.2, as the size of the pot increases in percentage of total chips, there is a direct correlation to a player's chance of calling and committing irrationality. Since players make decisions based on perceived gains, an increase in the pot's percentage of total chips seems more lucrative to continue playing, though it may in fact be correct to fold. The perceived gains have increased, and the only way to make the correct choice of play is by removing emotion-influenced behaviour from the decision-making process. Although in many cases an increase in the percent size of the pot does mean the correct play is to call, the size increase does not necessitate it. The rational play depends on many factors, the most important being the comparison of the decision-maker's pot odds to his odds of winning the hand.

Let us again use the example from figure 1.1. When Phil bets \$200 into a \$500 pot, it is in Doyle's best interest to fold. However, if the pot was \$1000 when Phil made a bet of \$200, Doyle's pot odds becomes \$1200:\$200 to call. We find that his pot odds, 12:2, are better than his odds of winning, 11:2, and therefore it would be correct to make the call. In the long-run, it would be a profitable play. However, if the size of the pot and the bet made by Phil increase

proportionally, as seen when Phil bets \$400 into a pot of \$1000, Doyle's correct play would be to fold. Though the pot is a greater percentage of the total chips, the bet does not warrant a call.

When we apply behavioural economics to a game of poker, we find a succinct explanation as to why poker players are susceptible to the gambler's fallacy. The gambler's fallacy is the false belief that a gambler's hot or cold streak will affect their future chance of winning, and occurs when there is a mistake in the understanding of mathematical probability.

Continuing with the above example, if Doyle had previously won the last three consecutive hands then he may commit the gambler's fallacy if either; a) he makes the call because, since he has won the last three consecutive hands, he believes he is more likely to win again, or b) he folds his hand because he believes Phil is due for a win. Notice that even when Doyle makes the correct play he can still be committing an irrational decision because he has made a decision based on faulty logic, an underlying problem that creates future complications in determining the correct play. That he has come to the correct conclusion is only coincidental – he has not followed the correct process to find it.

Kahneman and Tversky (1973) proved that people use certain heuristics, which are rules of thumb, to simplify complicated judgments. The availability heuristic is an example of a simple guideline that categorizes the likelihood of an event by how many times a person can think of that event occurring. By using the availability heuristic, people can make harder decisions more quickly, but are also susceptible to over-valuing certain variables if more examples of that variable comes to mind. In terms of poker, an observer might use heuristics when calculating their likelihood of winning a hand. While their decision on how to play may be found swiftly, the underlying process may be grounded in the gambler's fallacy.

For example, someone might analyze previous hand history to evaluate what their action should be, and might make one of two mistakes: they cannot find many examples of a player either winning or losing for as long of a streak as they have, and therefore the opposite option is more likely to occur; or, the chances of going on the winning or losing streak is so low that, since it has already happened, it is more likely to continue to happen. I believe the latter may fall under availability heuristic as a new example heuristic, where the economic agent believes they have found something significant and store in their memory a new guideline of the length of the streak

that has transpired. They may retrieve the information again if a similar streak arises, and will, if streaks of such a length or even longer continue to occur, start to believe that extending a streak is more likely than ending a streak.

If the new example heuristic is correct, it could additionally be applied to a decision-maker in the stock market. It can explain how the decision-maker may buy a stock on the grounds that the stock has been rising for an extended length of time, and therefore will continue to rise. If the stock does indeed rise, the decision-maker will be more likely to assume the next stock that has risen for the same length of time will also continue to rise. Only when the rising stock breaks the "pattern" will the economic agent realize the false trend, and stop adhering to the new example heuristic. The irrational behaviour would cause the economic agent to diverge from profit maximization.

The final corollary of valuing perceived gains in poker is when a player goes on tilt. A poker player is on tilt when they are "[p]laying much worse than usual because, for one reason or another, [they] have become emotionally upset". (Sklansky, 1999, p. 286) When on tilt, poker players generally know they are acting irrational, and yet continue to employ a non-correct strategy. Behavioural economics explains that their mindset has fallen away from profit-maximization due to the player's bounded willpower. An example in economics would be if a stock market investor had made huge losses on a variety of different stock options, they might stop caring about what happened to the rest of their investments. Though the investor would know the correct action would be to mitigate further losses, he has no willpower in following that advice. For the player on tilt, their bounded willpower has been constrained and they lack the process necessary in making correct plays. The only way to regain the rational economic mindset is by taking a break from the stress-inducing problem and calming down. ✓

### **Taking advantage of irrationality**

By using behavioural economic theory, a poker player can exploit an opponent's following variable tendencies: over-valuation of short-run benefits and under-valuation of long-run costs, gambler's fallacy (including new example heuristic), and bounded willpower. In order to use any of the above irrationalities to one's advantage, a poker player must induce the opposition to invoke emotion in their decision-making. Below I will evaluate how to capitalize

on another's irrationality by first devising a template poker situation, and then creating three examples that adopt the situation. Note that stronger players are better able to eliminate emotional behaviour in decision-making, and so these examples tend to work only against weaker players or stronger players who are playing weak.

Doyle is first to act in the final round of betting. There are two players to act after him: Phil and Vanessa. He knows Phil is a weaker poker player than him, and that Vanessa is a stronger opponent than him. A stronger opponent will be more likely to fold a hand than a weaker opponent holding the same hand because the stronger opponent knows the real value of his hand while the weaker opponent only knows the nominal value. In other words, the weaker opponent only sees the face value of his cards while the stronger opponent compares his cards to what he believes other players are holding. Therefore, we will assume that if Doyle opens with a bet then Vanessa will fold and Phil will make the call, even if Vanessa and Phil have similar hands. ✓

If Doyle believes he has a better hand than Phil, he can try to induce Phil into over-valuing his own short-run benefit. Doyle can achieve this by making a profit-maximizing value bet shown in figure 1.3, where Phil will make an irrational choice: he will believe the pot, which has been maximized of value, is too big to fold his hand. Phil will make the call, giving in to his over-valued perceived gains, and Doyle will have managed the greatest profit in the long-run.

In the second example, Doyle can coerce Phil into committing gambler's fallacy if Doyle looks at the poker game through Phil's perspective. By knowing if and when one or both of the players is on a streak, determined by what Phil believes to be the case, Doyle can effectively trap Phil into making an irrational move. For instance, if Doyle knows that Phil believes Doyle is on a win streak and is due for a loss, then Doyle can make a high-value bet with greater expectations that Phil will make the call. Note that it does not matter if one player or the other has been winning or losing consecutive hands; all that matters is what Phil believes. ✓

In the final example, Doyle can cause Phil to go on tilt by making very aggressive plays. If Doyle can make Phil lose a large pot, then Phil will exceed his bounded willpower and go on tilt. When Phil is on tilt, Doyle can be more liberal in his hand selection because Phil's hand

selection will be very wide; thus, Doyle can play more pots and effectively win more pots, capitalizing on Phil's irrational behaviour. /

### **Behavioural game theory**

Behavioural game theory expands on classical game theory by including human limitations. As Vincent Crawford stated when interviewed by Romesh Vaitilingam in 2008, an important distinction between behavioural and classical game theory is the attainability of Nash equilibrium in a zero-sum game. A zero-sum game is game where the amount someone wins is the same amount that someone else loses. Poker can be classified as a zero-sum game because all money goes into a pot, and when a person wins the pot everyone else has lost the same in total. Note that poker can also be a non-zero-sum game when a rake is involved, where a casino takes a portion of the pot every hand. However, out of simplicity we will only examine poker as a zero-sum game.

Nash equilibrium explains the equilibrium between two or more players in a zero-sum game. A game is at equilibrium when all players make the best decision, taking into account the decisions made by everyone else. Hence, an economic agent in Nash equilibrium cannot strategize any better unless someone else in equilibrium changes their strategy. Though all strategies are at equilibrium, they are not necessarily equal in payoff, as evident with bluff optimization. *500k's?* ?

Behavioural game theory is a supplement to Nash equilibrium. Classical game theory assumes that the players in the game have perfect knowledge of each other's strategies and can therefore decide their own strategy based on this information. However, we find in silent auctions that bidders do not have perfect information, and the winning bidder tends to over-value the item they won. Since everyone does not know the bids made by other bidders, a bidder is limited by their bounded rationality and might not estimate the average of other bids. If this occurs, and the bidder wins, they will have fallen into non-profit-maximizing behaviour. By taking into account the limitations of what humans can know, behavioural game theory can make better models of how people think strategically. /

## Taking advantage of behavioural game theory

There are two possible uses of behavioural game theory in poker. There is the issue of collusion in a poker setting, and optimization of bluff strategies. Behavioural game theory is especially useful when a poker player is facing a stronger opponent because when the bluffer plays the best possible strategy, taking into account other player's strategies, it is impossible for the stronger opponent to devise a better strategy to outplay the bluff optimizer due to Nash equilibrium.

For collusion, it may seem advantageous for two poker players to work together in order to maximize their profits. Collusion can happen by sharing card information with each other and/or by having both players raise and re-raise the pot to create more action from others at the table. Let us take three poker players, Doyle, Phil, and Vanessa, for an example of collusion in poker. Consider that Vanessa is the strongest poker player, and so Doyle and Phil want to collude together to get an advantage over Vanessa. We will also assume that Vanessa has no way of knowing that Doyle and Phil are colluding against her.

In figure 2.1, we are given two choices that Doyle and Phil can make. The first choice is to cooperate in collusion, while the second is to defect and try to take advantage of the other colluder. A player may choose to defect because they are being given card information for free, and can use this information to take advantage of their colluding partner. Assuming that Doyle and Phil share their earnings equally after the game, the diagram shows that both players will win half the pot when they cooperatively cheat. However, we also find that if Doyle cheats and Phil takes advantage of the card information he is receiving, then Phil will be able to receive the whole pot without splitting it with Doyle, and vice-versa. Therefore, Nash equilibrium would dictate that it would be in both Doyle's and Phil's best interest to defect from the other, leaving neither of them a winner. Therefore, collusion between two players becomes impossible. ✓

The most significant advance of behavioural game theory in poker is strategizing against stronger opponents. It is most useful in the context of trying to outplay your opponent, especially through bluffing. If Doyle is playing against Vanessa and she always seems to know when Doyle is bluffing or value betting, then Doyle can use behavioural game theory to switch decision-making by his judgments to mathematics (Sklansky, 1999, p. 180). Rather than deciding to bluff

after the river card has been revealed, Doyle can decide when he will bluff before the last card comes.

In figure 2.2, there are 8 cards in play, and so there are 44 possible cards that could be shown on the river. Vanessa's pair of Queens is best, and so Doyle's outs are Ax for two pair, Qx for a straight, Jx for 3-of-a-kind, or xd for a flush. The number of outs he has is 15 out of 44 possible cards. Therefore, Vanessa has 29 cards that will have her win.

Since Vanessa has known when Doyle was bluffing and when he was value betting, Doyle must take Vanessa's advantage away from her by randomizing when he bluffs. He can do so by deciding how many and which cards he will bluff on the river. If he chooses 10 cards to use as bluff cards, there will be 15 cards he can hit to make the best hand, 10 cards he can bluff to try to steal the pot and 19 cards where he will only check. For bluff optimization to work, he will need to give Vanessa the same pot odds ratio as his outs-to-bluff cards ratio. He has 15 outs to 10 bluff cards, or 3:2, and so with a pot of \$200 he will need to bet \$400 on the river for Vanessa to have pot odds of \$600:\$400 or 3:2.

Figure 2.3 shows when Doyle will win money and when he will lose money. As Doyle keeps the same strategy, Vanessa knows that when Doyle checks then she has the best hand. However, when Doyle bets she does not know if he is bluffing or has the best hand, and so can only do one of two actions: call his bet or fold. If she always folds, then after 44 hands Doyle will have made \$1200. If she always calls, then after 44 hands Doyle will again have made a profit of \$1200. By having the pot odds for Vanessa the same as the hits to bluff cards ratio for Doyle, it does not matter what action Vanessa takes because Doyle will make the same amount of profit in the long-run.

Due to bounded rationality, bounded willpower, and imperfect information, the optimized bluffing equilibrium may not be profit maximizing. If Vanessa calls too much, either because she is on tilt or is over-valuing her short-run benefits, Doyle should bluff less than what is at equilibrium. Else if Vanessa folds too much, which may be because she is trapped in the gambler's fallacy, then Doyle should bluff more than what is at equilibrium. By implementing behavioural economics, Doyle can better accommodate the irrational behaviours that Vanessa may be prone to if she starts playing weaker, thus maximizing Doyle's profit.

## Conclusion

In conclusion, there are many ways of applying behavioural economics in poker to create an advantage over another player. It can be implemented to predict future irrational moves by a player, and can also give an advantage against a stronger opponent. Prospect theory proved that people make decisions based on perceived gains instead of perceived losses, and could therefore be exploited to make irrational calls. It was also shown that people use the availability heuristic as a judgment tool, which may influence greater implementation of gambler's fallacy. Players are also subject to bounded willpower when they go on tilt, making irrational plays even while knowing the play is irrational. Behavioural game theory was applied to poker to prove that collusion does not work, and that a weaker player can optimize their bluffs against a stronger player. Bluff optimization equilibrium can also be modified to accommodate players who call too many hands or fold too many hands.

The results of the investigation are limited by the assumption that the poker players are playing for money and not for another objective such as for fun. Also, there are still two unresolved questions about applying behavioural economics to poker: bounded selfishness of poker players and behavioural game theory in non-zero-sum poker games. Both of these questions qualify as excellent candidates to further investigate the topic of behavioural economics in poker, but for now shall remain as questions. In the end, my investigation fulfilled its objective by showing that behavioural economics has feasible application at the poker table.



# Diagrams

Figure 1.1 - Over-valuation of perceived gains

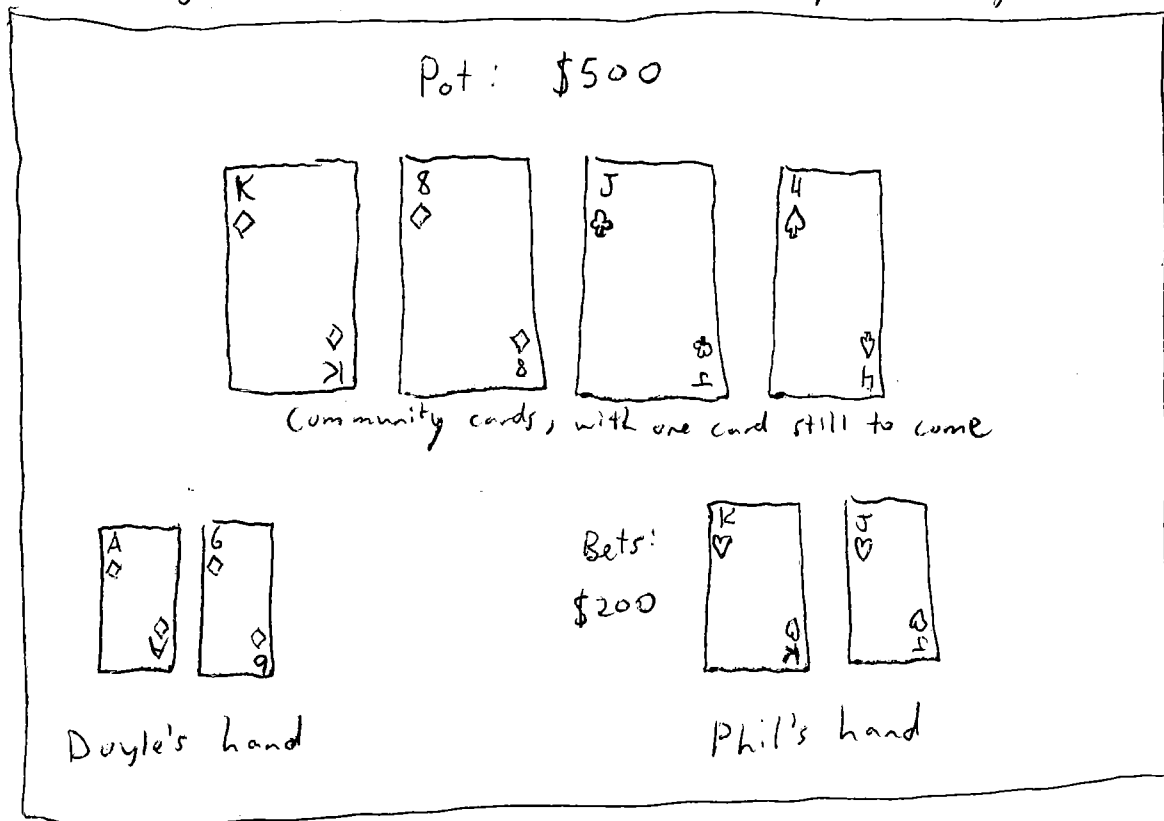


Figure 1.2 - Relationship between size of pot and probability of making a call

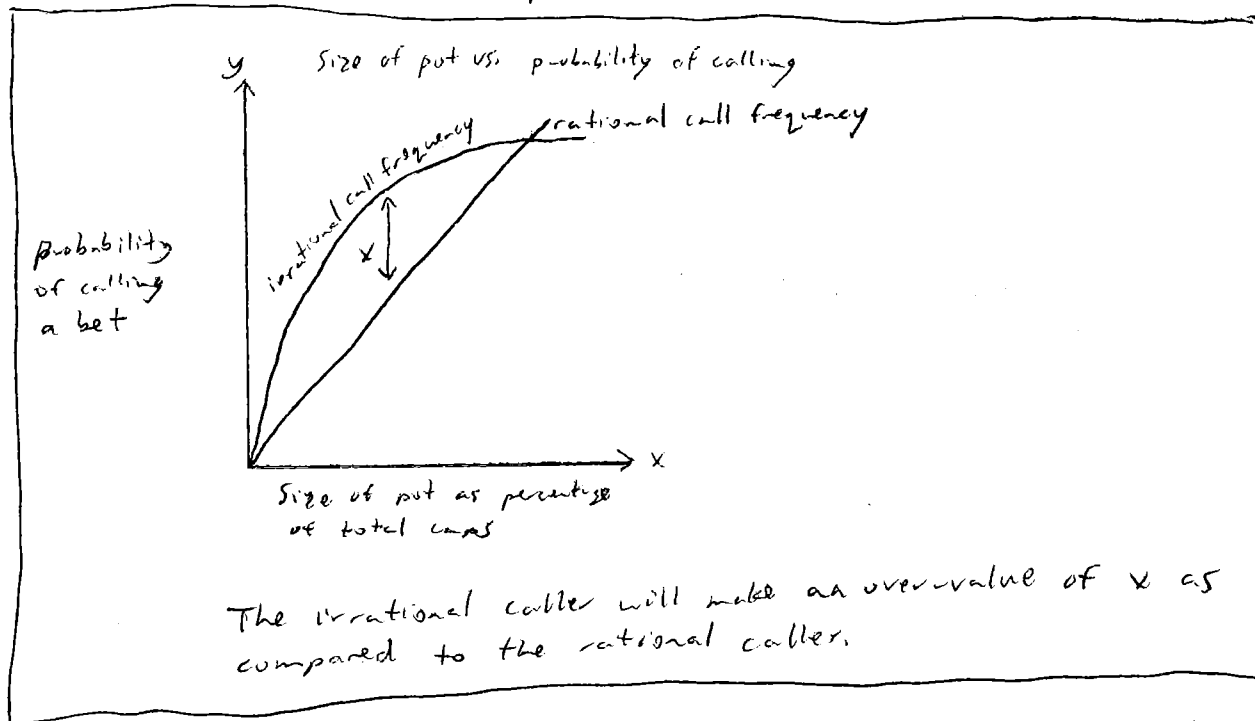
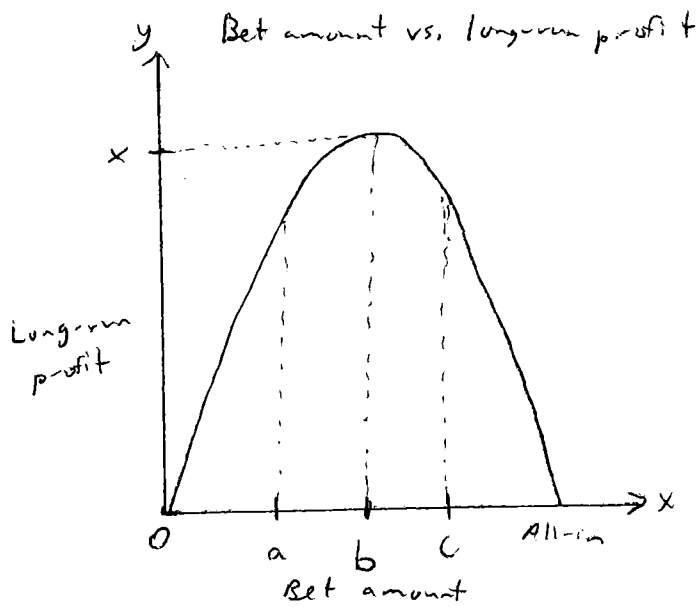


Figure 1.3 - Value betting



$b$  is the profit-maximizing value bet.

Note: In general, an all-in bet does not work as a value bet because the player will know that the better has more than just a hand of value.

Figure 2.1 - Collusion Diagram

		Doyle		
		Cheat	Defect	
Phil	Cheat	$\frac{1}{2}, \frac{1}{2}$	$-1, 1$	
	Defect	$1, -1$	$0, 0$	} neither wins

Numbers are shown as fractions of the pot won or lost by each player.

Figure 2.2 - Bluffing hand example

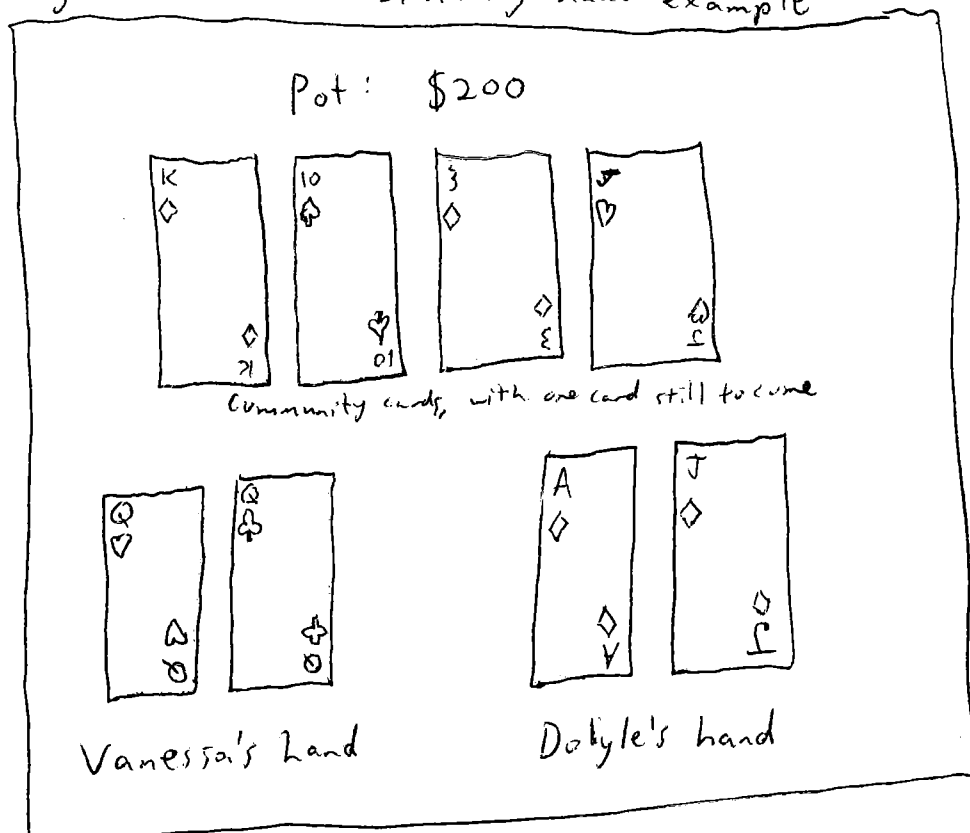


Figure 2.3 - Doyle's expected value

Number of cards	Type	Bet (by Doyle)	When Vanessa always folds	When Vanessa always calls
15	Doyle's valued cards	Yes	200	1000
10	Doyle's bluff cards	Yes	200	-1000
19	Vanessa's cards that will let her win	No	-200	-200
Total, over 44 hands			\$1200 profit	\$1200 profit

The positive and negative is based on Doyle's perspective, where positive denotes (positive) gain and negative denotes (negative) loss

Vanessa always wins this money because Doyle will not bet here

## Appendices

### A – Rules of Texas Hold ‘Em

Texas Hold ‘Em is the most popular variant of poker. Each player starts with two cards face down, and uses these two cards with five face-up cards in the centre of the table (known as community cards) to make the best five-card hand. (See Appendix B – Ranks of Hands for more details.)

There are four rounds of betting in Texas Hold ‘Em. In the first round, two players are forced to bet, or put money into the centre which builds a pot, where one player pays the big blind and the other pays the small blind, which is half the big blind. Since these players are forced to bet, they get to act last in the first round of play. There is also a dealer each round who plays before the small and big blinds in the first round and plays last in the subsequent rounds. These three positions are moved clockwise after a hand is finished, which allows everyone an opportunity as the blinds and as the dealer.

Once the blinds put their money into the pot, everyone is dealt their two cards face-down. The first round of betting occurs, and the first player to act must put the same amount of money into the pot as the big blind, put more money than the big blind, or else drop out of the betting. These actions are respectively known as calling, raising, and folding. There is generally a maximum amount of times in a round that the bet to continue playing can be raised. However, in No Limit Texas Hold ‘Em, the players can bet any amount they want up to all the chips they have on the table. By placing all of your chips in the middle, you are going all-in. When a player goes all-in, a new side pot is created for players still in the game. A player all-in can only win the main pot, while other players can win the main pot and the side pot.

Once everyone has acted in the first round and at least two people are still playing, three cards, called the flop, are flipped face-up to form the community cards. A second round of betting occurs, and the first player can either put money into the pot or do nothing and let the next person act. These actions are respectively known as betting and checking. Once everyone has acted, the fourth community card (called the turn) is flipped face-up. A third round of betting takes place. The final card, the river, is then flipped face-up and the fourth and final round of betting takes place. Whoever is left in the pot shows their hand, and whoever makes the

best five-card hand wins that pot. Then, the blinds and dealer shift one seat clockwise and the next hand begins.

## **B – Rank of hands**

The hand strength in order from strongest to weakest is as follows:

1. Royal Flush – The best hand in poker, the Royal Flush is a straight of 10, Jack, Queen, King, and Ace, all of the same suit.
2. Straight Flush – Like the Royal Flush, the Straight Flush is five consecutive cards that are all the same suit. For example, a 4, 5, 6, 7, 8 all of clubs would be a straight flush.
3. Four-of-a-Kind – A four-of-a-kind is four of the same card value, and a high card to complete the five-card hand. For example, having all four Kings and a 10 would be a four-of-a-kind. It is more likely to get a four-of-a-kind than a straight flush, but it is still very difficult to achieve a four-of-a-kind.
4. The next best hand is a full house, or a three-of-a-kind and a pair. Having three Queens and two nines would be considered a full house.
5. The flush is the next hand in the ranking. It is one part necessary in getting a straight flush, where it is five cards of the same suit.
6. The straight is the 6<sup>th</sup> highest hand in the ranking. It is five consecutive cards, but those cards do not need to be of the same suit. An Ace, 2, 3, 4, 5 would be an acceptable straight, 10 to Ace would be acceptable, but it is not acceptable to “mix” the two straights. That is, you cannot have a straight that connect King and Ace to a 2.
7. The three-of-a-kind, or three of the same card value, is below a straight on the hand ranking.
8. A two-pair or two two-of-a-kinds is below three-of-a-kind and above the one-pair. An example would be the five-card hand Jack of hearts, Jack of diamonds, 5 of spades, 5 of clubs, and an Ace of spades. The player would have two Jacks and two 5s.
9. The second-lowest hand is a one-pair, which is the same as a two-pair except in the above example you might have only the two Jacks.
10. The lowest hand on the ladder is high card. This is when you have 5 unique cards that are not consecutive and are not the same suit. The highest card (Ace, King, Queen, etc.) is

your high card hand. For example, if I had only high card and my highest card was an Ace, then my hand would be called "Ace high".

## **C – Abbreviations**


In some of my examples in my essay, I used abbreviations for the cards in my hands instead of the full names of each card. Here I will describe in brevity what each abbreviation signifies.

First, an example of an abbreviation would be Ad. This represents a single card, and is composed of the face value of the card and then the suit of the card, always in that order. So for Ad, it means "Ace of diamonds". Also, I used an x such as in 8x. The x represents any possible value of either the face value of the card or its suit, depending on if the x comes first or last in the abbreviation. For 8x, it simply means "8 of any remaining suit". If the abbreviation was xs, it would be "any remaining face value of spades".

Here is a list of abbreviations for face values:

- A – Ace
- K – King
- Q – Queen
- J – Jack

Here is a list of abbreviations for suits:

- d – diamonds
  - c – clubs
  - h – hearts
  - s – spades
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## D – Glossary of poker terms

For a person who is new to poker, there are some terms that they may not understand. Therefore, I have decided to add a glossary of poker terms in my appendix section. Each term will be briefly described here, but they will not be highlighted in my essay.


Bluffing – Betting with a hand that has little or no value, especially compared to the cards your opponent might be holding. A bluff is an attempt to scare another player out of the pot, or in the case of behavioural game theory it can be used to gain an advantage over stronger players.

Hand selection – The basic criteria for choosing what cards you want to bet or fold when you are dealt your two cards. A person who is considered “tight” will have a hand selection that is very selective. A person who is considered “loose” will play a lot more hands and have a wide hand selection.

Outs – The cards that you can hit on the turn or river which will improve your hand. For instance, if I am holding Ad, Kd to a flop of 4d, 8d, and 10h, my outs would be Ax, Kx, and xd.

Pot odds – It is a ratio of money in the pot to the amount of a bet. For example, if there is \$300 in the pot and someone bets \$200, the pot odds for the next person to act would be 3:2.

Value bet – A bet that tries to maximize the profit you can receive. A person value bets when they have a hand that they believe to be the one. It is the opposite of bluffing because when you bluff you want your opponent to fold, whereas when you value bet you are hoping to get called.



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